

WASHINGTON

SCIENCE TRENDS

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* NASA MATERIALS RESEARCH

National Aeronautics and Space Administration is establishing a new Materials Research Programs Division in Washington in recognition of the increasing importance of such programs in aeronautical and space development. The new office will be headed by George C. Deutsch, formerly head of the Refractory Materials Branch of NASA'S Lewis Research Center. Determining future research funding will be a major responsibility of the new Division.

* NEW LABORATORY EQUIPMENT

National Science Foundation is seeking proposals for prototypes of new laboratory equipment to be designed by scientists and science teachers in colleges, universities and non-profit organizations. Equipment must be suitable for laboratory, lecture demonstrations or field work at any educational level in mathematics, engineering, earth and atmospheric sciences, physical and biological sciences, anthropology and experimental psychology. Deadline for this year's program is December 15, 1960. (For details write Course Content Improvement Section, National Science Foundation, Washington 25, D. C.)

* COMMUNICATIONS SATELLITES

The Army Signal Corps has taken over management responsibility from the Advanced Research Projects Agency for the \$23 million Courier and \$174 million Advent communications satellite research and development programs.

✓ Courier is an experimental r&d vehicle designed to provide delayed communications capabilities in a 650-mile, near equatorial orbit. The 500-pound satellite is expected to be able to simultaneously send and receive 340,000 words in a five-minute period while in range of ground stations located at Ft. Monmouth, New Jersey and Puerto Rico.

✓ Advent has been cut back to an r&d/feasibility study for a microwave communications satellite operating in a 24-hour equatorial orbit at a height of 22,300 statute miles. The half-ton satellite will be operated with the aid of ground stations in the vicinity of Camp Roberts, Calif. and Ft. Dix, N. J. and a shipborne station. An eventual series of real time repeater satellites -- able to relay messages directly, is planned. The estimated cost includes launching vehicles.

* PROJECT TIROS

Foreign scientists are invited to participate in the next Tiros weather satellite planned for launching later this year. They will receive orbital information and cloud cover photos for comparison with their own observation programs.

***** SOLID PROPELLANT ROCKET RESEARCH

Here is a summary of the latest reports by the National Aeronautics and Space Administration on solid propellant rocket research:

Ø Upper Stage Rockets

- ✓ NASA is interested in the potential weight saving capabilities of a nozzle cooled by liquid metal. It is believed that this may allow the use of very thin metal nozzle cones -- if the liquid metal can be kept in uniform contact with the cone to absorb the heat generated by exhaust gases.
- ✓ Another field to be investigated is the performance potential of a rocket engine which has no conventional nozzle. It is expected that such an engine would not be as efficient but might be attractive for some applications in which low weight, simplicity, reduced cost and improved reliability are desirable.
- ✓ NASA expects to evaluate use of several concentric layers of different solid propellants to permit a simple internal shape which would require almost no chamber insulation. A test unit of 600 pounds and including a plastic chamber made in two halves, is a major part of this effort.
- ✓ The potential of end-burning propellant charges in upper stage rockets of low weight is also being investigated. It is explained that because end-burning charges have no central perforation, all the chamber volume is needed, giving added efficiency. This may also allow more flexibility of rocket burning power.
- ✓ An experimental rocket engine with a very high proportion of weight of propellant is being developed for NASA. In early tests two 500-pound engines failed soon after ignition but modifications were expected to correct these problems.

Ø Large Boosters

NASA is evaluating study programs conducted by Lockheed Aircraft and the Aeronutronic Division of Ford Motor Company which indicate that -- on the basis of overall vehicle design -- a solid fuel booster can be more efficient than a liquid booster. NASA was advised that solid units can readily be designed to deliver maximum thrust at a given total vehicle weight, while liquid rockets are "more limited" because of the size of the fuel-feeding machinery required. It was also pointed out that, by developing a higher thrust-to-weight ratio, the solid unit attains full velocity more quickly and minimizes velocity loss due to gravity. For a given total vehicle weight, it is also said to be more efficient to use a solid booster. This is based on the assumption that more weight could be concentrated in the upper stages.

Ø Steering and Velocity Controls

Experimental Vehicle Steering and Velocity controls are being developed for NASA by contractors selected earlier this year. In addition, a NASA contract with the Naval Ordnance Test Station, Inyokern, Calif., calls for a study of the feasibility of controlling thrust direction by injecting gas or liquid into the nozzle expansion cone. In theory this injection causes a shock wave to form in the cone, deflecting the main exhaust by several degrees. This may make it possible, NASA says, to steer a vehicle by injecting on command at different cone locations -- particularly for large initial stages requiring great forces.

***** SOLID PROPELLANT ROCKET RESEARCH (Continued)

♂ Thrust Modulation

Under a NASA contract, Acoustica Associates, Inc. of Los Angeles has been experimenting to determine if the thrust level of a solid-fuel rocket could be varied by adding acoustical energy or sound waves to the burning propellant surface. In this program, attempts have been made to generate controlled energy by means of a siren or whistle, and apply it to propellants burning under pressure. First tests, with propellant strands in a closed pressure vessel, produced no noticeable results. Since then, small rocket engines have been fired in which an induced thrust level variation of about 10 percent have been noted. The sonic source was a highly efficient whistle generating over 150 decibels in air at a frequency of about 10,000 cycles per second.

♂ Materials and Manufacturing Techniques

One major NASA contract in this field, with the ARDE-Portland Corp., Newark, New Jersey, emphasizes materials suitable for constructing high temperature nozzles. In one early test, a nozzle throat section of high density metallic carbide is reported to have withstood exhaust conditions considerably more severe than is to be found in present day rockets. According to NASA, the theoretical temperature of the flame was 6700° F -- and during the 39 second burning time the 3/4 inch diameter throat increased only .04 inches.

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* MEGAROENTGEN DOSIMETRY

A simple film method developed at the National Bureau of Standards is said to facilitate the measuring of X- and gamma-ray exposure doses in the megaroentgen range. The new technique is expected to have important advantages in the study of radiation-induced changes in materials, the field of radio-biology, and the irradiation of foodstuffs for long-term preservation.

No photographic processing of the film is required, according to the Bureau, and commercially available film types can be used. The method, developed under Atomic Energy Commission sponsorship, is also said to avoid difficulties encountered with other dosimetry techniques currently employed.

Exposures over the relatively wide range of 10^4 to 10^8 roentgen can be measured with good reproducibility under the new technique. Darkening of the film is read directly with a conventional photoelectric densitometer. The light source is filtered to pass only the narrow band of wavelengths -- in the red or near infrared -- for which the decrease in transmittance of the film is a maximum. Then, the net optical transmission film density is related to the unknown radiation exposure through the use of experimentally determined calibration curves.

(For further details on Megaroentgen Dosimetry write National Bureau of Standards, Office of Technical Information, Washington 25, D. C.)

TECHNICAL TRENDS

□ Test equipment for the direct production of hydrazine rocket fuel from plentiful and cheap liquid ammonia is being installed by Aerojet General Nucleonics under a contract with the Air Materiel Command. ✓✓✓ Studies recently published by the Lawrence Radiation Laboratory, Livermore, Calif. indicate that underground nuclear explosions could profitably be used in conjunction with a mining technique known as "block-caving" which involves tunnelling under bodies of ore. As much as a million tons of ore might be crushed in a single detonation, with no surface release of radioactivity. ✓✓✓ The U. S. has recommended that the International Atomic Energy Agency develop programs to facilitate use of computers by Member States which do not have such facilities; establish a library of reactor codes, and set up a committee to coordinate the accumulation of cross section data.

□ Wright Air Development Division, Wright Patterson Air Force Base, Ohio has presented a \$1700 award to employee John J. Rose for inventing a means of automatically obtaining a quick engine relight after a flameout, without reducing altitude or airspeed. The invention is adaptable to all turbojet, turboprop and turboprop powered aircraft and works by providing a continuous ignition source during flight, or by use of an instantaneous flameout detector and switching device. ✓✓✓ Sperry Gyroscope Co. receives a \$4.5 million production contract for the production of a new, extremely accurate and wide-range passive underwater detection system. The system is compatible with existing submarine fire control equipment.

□ Another reorganization may be forced upon the Air Force Air Research and Development Command. ARDC recently ran into Pentagon difficulties over its role in missile base activation and has now lost much of its control over the high-priority SAMOS reconnaissance satellite program. ✓✓✓ The infrared reconnaissance role of the Navy's Transit satellite is being kept under tight Defense Department security wraps. ✓✓✓ Tests recently completed at Edwards Air Force Base, Calif. demonstrate that Hound Dog missiles can be employed for additional takeoff thrust by carrier bombers. The missiles are then refueled in flight by the bomber, with no decrease in the missile's striking range.

□ General Services Administration is still trying to dispose of 4,413 tons of demilitarized cadmium-magnesium alloy bomb bodies. A high bid of 11.35 cents per pound was rejected as inadequate. For information contact James V. O'Dwyer, Room 6030, General Services Administration Bldg., Washington 25, D. C. ✓✓✓ The operational version of the Midas infrared warning satellite will draw its power from solar cells in a paddlewheel configuration similar to that used in the Pioneer V space probe. ✓✓✓ The U. S. Navy is actively interested in developing automatic controls for submerged foils in hydrofoil craft. Angle of attack or the flap position of such foils must be adjusted continuously. Tests with an electronic sensing system indicate that adjustable foils minimize pitching and heaving motion, even in rough seas.

□ U. S. Bureau of Mines is encouraged by test runs of its new pressure gasifier for the gasification of American lignite -- both as a future source of chemicals and as a substitute for natural gas. ✓✓✓ An adjustable sliding waveguide termination developed at the National Bureau of Standards is said to reduce reflections to a minimum in microwave measurements. The instrument is said to be more stable and of simpler and more durable construction than previous devices of this type. ✓✓✓ National Science Foundation funds are supporting development, at the University of Pennsylvania Museum, of a "completely new" approach to archeology -- a probe operating on an echo sounding principle.

I N V E N T I O N S W A N T E D

The Armed Services and various civilian agencies of the U. S. Government look to private industry, research organizations and the individual inventor for assistance in solving these problems.

Subscribers interested in these requirements may write Service Department, Washington SCIENCE TRENDS, 1120 National Press Bldg., Washington 4, D. C. You will be furnished with the Official Requirement Number and Title, and with information on how and where to submit proposals.

- HIGH TEMPERATURE ELASTOMERS -- Available elastomers cannot be used for gaskets and hoses which require service at high temperatures, in contact with hydraulic fluids and other chemicals. The Government is seeking new materials which will meet these very unusual requirements.
- WIDE-AREA PRESSURE FUSING FOR MINES -- Present anti-personnel mines must be stepped on directly or activated by trip wires. The military feels that neither is entirely satisfactory from a point of view of logistics, high cost and other considerations. The need exists for a wide-area, low-cost pressure fuse which could effectively increase the radius of activation.
- HIGH PRESSURE SEAL -- This requirement specifies a high-temperature seal capable of operating in the pressure range of 25,000 to 60,000 psi. In addition, it should be usable in both static and dynamic applications.
- DRY LUBRICANT -- Present knowledge indicates that so-called "dry films" may be feasible for lubrication over a wide temperature range. The Government says this might be from - 65° F to 1200° F.
- AUTOMATIC TRANSMISSION EQUALIZER -- This requirement relates to the transmission of digital signals for security systems over technical military circuits. This brings about the problem of constantly changing circuit characteristics. The Government is interested in a technique to provide automatic phase and amplitude compensation -- so that the characteristics of the circuit will be readjusted to compensate for changing line conditions.
- THERMIONIC DIODE -- The Government is seeking a technique which would permit very close spacings (below the order of .0001 inch) between the emitter and collector of a thermionic diode employed in a thermal-to-electrical energy converting system. Spacing must be stable with time and temperature and the technique must not contaminate either the collector or emitter surfaces.
- INTERMITTENT MOVEMENT, HIGH SPEED CAMERA -- This must be a full frame 35 millimeter camera capable of operating at speeds up to 400 frames per second for slow motion studies of rocket and missile testing. Maximum image resolution, sharpness and quality are required.
- NEUTRON SHIELDING -- This shielding must be highly effective, light weight, inexpensive and easily applied. It may absorb or reflect the radiation -- or convert it to less damaging or more easily handled forms.

P U B L I C A T I O N C H E C K L I S T

- ☐ ARMED SERVICES PROCUREMENT REGULATION, a new and up-to-date edition of the rules and regulations to be followed by contractors dealing with the Department of Defense and various military agencies. 1038 Pages, in loose-leaf form punched for three-ring binders. (Binder not furnished). Price includes supplements for approximately two years. \$18. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C., for Armed Services Procurement Regulations -- 1960 edition.)
- ☐ GOVERNMENT PATENT PRACTICES, a transcript of hearings before a Congressional committee dealing particularly with patent affairs involving the National Science Foundation; Department of Health, Education and Welfare; Tennessee Valley Authority and the Veterans Administration. 256 Pages. Single Copies Free while available. (Write Committee on the Judiciary, Subcommittee on Patents, U. S. Senate, Washington 25, D. C., for Hearings -- Government Patent Practices.)
- ☐ WEAPON-SYSTEM SUBCONTRACTING, harsh words by a Senate subcommittee on a decision to make rather than buy ground support air conditioning equipment for the B-58 bomber program. 19 Pages. Single Copies Free. (Write Select Committee on Small Business, U. S. Senate, Washington 25, D. C., for Report No. 1947.)
- ☐ ATLANTIC MISSILE RANGE, a brief Congressional report now available in printed form on facilities at Cape Canaveral and some management problems there. Eleven Pages. Single Copies Free. (Write Committee on Science and Astronautics, U. S. House of Representatives, Washington 25, D. C. for Report -- Management and Operation of the Atlantic Missile Range.)
- ☐ DEFENSE DEPARTMENT ANNUAL REPORTS, includes the statements of the Secretary of Defense and the Secretaries of the Army, Navy and Air Force on programs for the fiscal year which ended June 30, 1959. Next year we will find out about this year. 410 Pages. \$1.25. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C., for Publication No. D 1.1:959.)
- ☐ COBOL, a technical reference manual including specifications for a common business oriented language (COBOL) for programming electronic digital computers. 180 Pages. 75 cents. (Available through Military Channels or Superintendent of Documents, Government Printing Office, Washington 25, D. C., for Publication D 1.31:960.)
- ☐ ENERGY FROM URANIUM AND COAL RESERVES, a May, 1960 study prepared by the Atomic Energy Commission estimating domestic and free world uranium resources and recoverable coal reserves. Presents an evaluation of the heat energy available from each. 7 Pages. 50 cents. (Available through AEC Channels or order Report TID - 8207 from Office of Technical Services, Department of Commerce, Washington 25, D. C.)
- ☐ WATER, a new non-technical "primer" covering the basic principles of hydrology as well as the magnitude and use of the total supply of water in the United States. Authoritative information is presented in easy-to-read form. 50 Pages. 35 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D. C. for "A Primer on Water".)
- ☐ INFLATABLE STRUCTURES, a technical study of the structural considerations for inflatable re-entry gliders concluding that "while there is much work yet to be done, the creation of rational design procedures is indeed possible." 23 Pages. Single Copies Free. (Write National Aeronautics and Space Administration, Att: Code BID, Washington 25, D. C. for NASA Technical Note D-457.)

